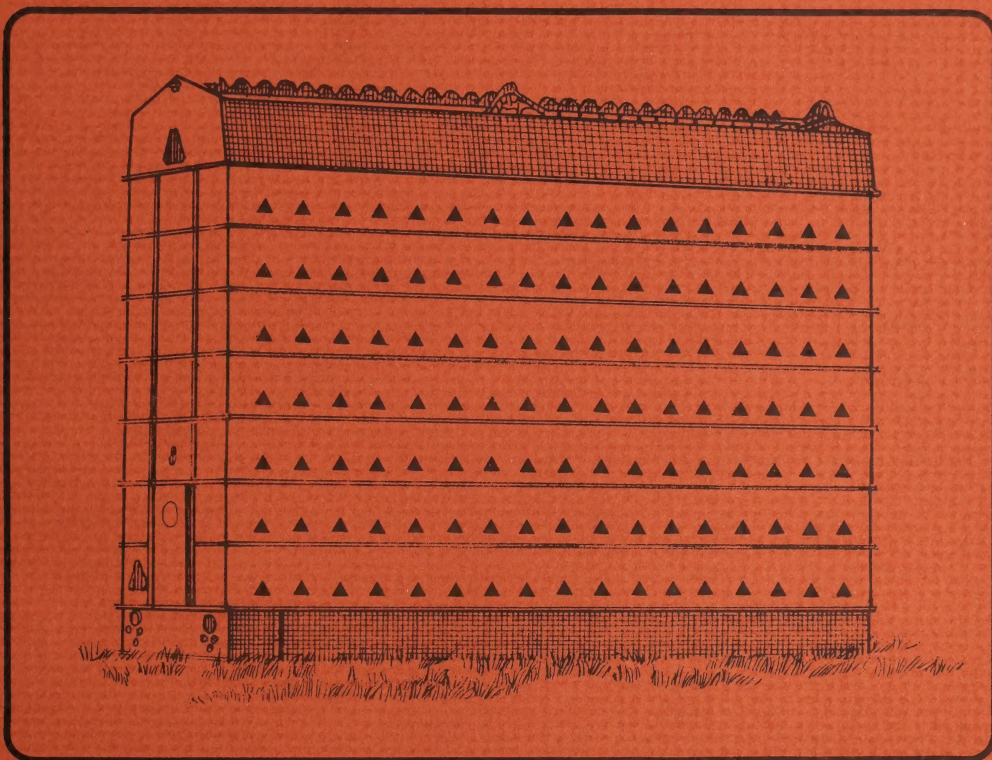# The Economics of Grain Drying

AGDEX 825-21

Alberta
AGRICULTURE
Farm Business
Management Branch

PREFACE

Investing large amounts of capital in farm machinery and other capital assets when prices of farm produced commodities were high has caused many farmers to regret their earlier decisions since prices have dropped. Farm managers must constantly make decisions about investing as they are deciding and choosing among alternative ways of using their farming resources to achieve their goals. Practical decision-making tools can assist farm managers in their most important activity.

This article is intended to demonstrate the use of a partial budget in forecasting the result of a change in one part of an on going farm operation. Although the purchase of a drying system is used in this example, the method of partial budgeting can be used to analyze any change in a farm operation. Using the method outlined will help farm managers to improve their decision making and make progress toward their goals.

The Economics of Grain Drying

Introduction

Large amounts of capital are invested in farming to acquire land, machinery, buildings and other assets. Financial decisions that were made in good times may be the cause of cash flow difficulties for farmers when prices fall. This article presents a simple method of doing a financial analysis before making a decision to acquire a drying system.

Objective

The objective of this factsheet is to help farmers answer their four most important questions regarding investing in a grain drying system.

1. What are the advantages and disadvantages?
2. Is it profitable?
3. How will it affect cash flow?
4. What are the risks?

What are the advantages and disadvantages of a grain drying system?

Farmers should approach the topic of buying grain drying equipment from the standpoint of harvest management (e.g. an earlier harvest) rather than just for use in an emergency situation such as a wet fall.

Suppose a farmer has 1000 acres to harvest. Think of the acreage divided into four equal parts of 250 acres. Traditionally, this farmer begins combining when the first grain is nearing dry (e.g. 14.5% moisture for wheat). However, by using grain drying equipment the harvest could start four to six days earlier while the cereal grain moisture content is still in the tough or damp stage. Drying would begin immediately and by the time the first quarter of harvest (i.e. 250 acres) is completed, the grain in the second quarter could be testing dry.

In other words, one-quarter of the harvest could be finished by the time the farmer would otherwise just be starting. Although only the first 250 acres are completed earlier than usual, the grain harvested in the last 250 acres has greatest potential to gain from the earlier harvest. The 4 to 6 days gained at the beginning of a harvest could mean 7 to 10 or more days saved later in the harvest season when the natural in-field drying rate is slower.

Earlier harvest - By starting earlier in the season, not only will the harvest be started earlier, but the total time required to complete the harvest will be shortened. This will allow more time after harvest for other activities (e.g. fall tillage, weed control, fertilizer application, winter preparations).

More harvest time - By harvesting grain as tough or damp and using artificial drying, one can make use of more harvesting hours per day and more harvest days per season. A better utilization of labor would result by spreading out the harvest work before the big push when grain tests dry.

Less machine investment - Because the total number of available harvest hours is increased by using a dryer, overall investment in machinery can be reduced. For example, buying a dryer for use with your present combine may be a better alternative to buying that larger or second combine. Along with the saving in combine investment there could be a corresponding saving in truck investment.

With a dryer in the system, straight combining becomes more feasible. Because an earlier harvest is possible, the risk of a wet snow on the standing crop is lessened. Also green kernels (second growth) pose less of a problem with a dryer in the system. By being able to straight combine part or perhaps all the crop, harvesting could be further advanced and the need for a swather might be reduced.

Field losses minimized - The longer that grain is exposed to the weather, the greater the likelihood

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Table 1

In-Field overdrying costs
Assume Grain Overdried by 2%

Crop Choice	Value/Tonne ($)	Loss/Tonne ($)	Loss/Bushel (¢)
Barley	110	2.60	5.6
Wheat	165	4.00	10.8
Rapeseed	350	8.40	19.0

Dry grain is easier to market and the price discount for tough or damp grade can be avoided.

Table 2   **Discount for Tough and Damp Grain ($/Tonne)**

Grain		Tough	Damp
Wheat	(14.5 - 17.0%)	7.00	
	(17.0% +)		14.50
Barley	(14.9 - 17.0%)	6.00	
	(17.0% +)		12.50
Oats (14.0 - 17.0%)		6.00	
	(17.0% +)		13.50
Rapeseed	(10 - 12.5%)	11.00	

(Discount for nonboard grain may vary between companies)

of grade loss, bushel weight loss, poor germination and loss of feed quality. Because a drying system enables harvest to be completed earlier and in less time, weather-induced grain deterioration is reduced. Losses caused by wildlife can also be minimized.

For crops that are swathed before combining, a quicker harvest will give the swath less time to settle, thus reducing pickup losses. Tests have shown that swathing and combining grain at higher moisture content results in less shelling out and less cracked grain.

Marketing advantages - Harvesting at a higher moisture content and drying the grain allows the farmer to market the grain at the optimum moisture content where grain weight is highest. Allowing nature to overdry grain in the field can be expensive.

Avoid postharvest loss - Losses from spoilage and associated in-bin insect damage can be reduced or eliminated. Finally, by advancing the harvest a week or more, completion is usually achieved earlier.

Is it profitable?

Farmers considering investing in a dryer will have many ideas as to where they expect to increase returns or decrease returns. But to answer the question of whether it will be profitable, they need to put all the available information on a partial budget worksheet so they can summarize all the associated costs.

The following is an example of some of the many ways in which a drying system may increase returns. The farm in the example has 1000 cultivated acres and is continuously cropped to wheat. The farmer is considering buying a portable continuous flow dryer with a capacity of about 300 bushels of wheat

per hour. A hopper bottom wet grain surge bin, a dry grain auger and a moisture meter are also required.

Total investment expected is:

Dryer	$24,000
Propane tank	2,000
Auger	1,500
Bin	1,500
Moisture metre	1,000
Total	$30,000

The farmer expects the system to be used for 10 years and sold with a salvage value of $5,000 at the end of that time. The farm is in a wet area where the farmer expects to dry 50 per cent of the crop in the average year - about 500 acres of wheat averaging 35 bushels per acre.

The next step is to list the advantages and disadvantages of using the drying system and placing a dollar value on every detail. In other words the farmer can estimate the costs and benefits of the drying system by using a budgeting procedure.

A partial budget format is shown on the following page; note that it is divided into quadrants. In the appendix are four pages of detailed partial budget worksheets, each page corresponding to one of the quadrants shown in the partial budget. Complete each page in detail, then summarize it and enter it in the corresponding quadrant of the one-page partial budget.

Start by completing worksheet page 8, corresponding to quadrant 1 of the partial budget. The disadvantages are entered on page 8, these would be the added annual costs expected. Work through the other three worksheet pages putting values on the disadvantages and advantages. Then summarize this information on the partial budget as shown for the sample grain drying system.

Using a Partial Budget

The partial budget on page 4 shows the estimated change in annual farm profits to be $3,965 under the circumstances described. In other words, the grain drying system being considered

should be profitable and acceptable. The investment of $30,000 should pay the average annual costs (disadvantages) of $8,231 and leave $3,965 of surplus.

Using the method above, different drying systems could be compared and a decision made on which drying system to choose.

A farmer could consider a natural air drying system where the capital investment may be much less. The system may have fewer advantages (added annual receipts plus reduced annual costs) but also may have fewer disadvantages (added annual cost plus reduced annual receipts). If the less costly system can remove most of the risks of not having any drying system, it may be adequate and produce more annual farm profits than the system with a higher capital investment. On the other hand, such a system may not reduce the risks enough and be inadequate for the needs of the particular farmer in a particular situation.

Partial budget estimates provide a method for farmers to use in comparing different systems in a systematic, analytical way. This method will help farmers to put down on paper their reasons for making decisions and help them to make better decisions in the future. Having the calculations on paper may also be helpful in explaining to spouses, children, partners and even lenders why the proposed investment is a good idea.

How Will it Affect Cash Flow

The partial budget showed an expected increase in profits of $3,965 with an allocation of interest costs and depreciation amounting to $5,025 per year. In other words the capital cost of $30,000 less the estimated salvage value of $5,000 at the end of 10 years was spread over 10 years. Annual depreciation charges are estimated to recover the cost of an asset over time and annual interest charges represent the opportunity cost of capital. These accounting procedures are useful and acceptable for the purpose of estimating profitability when considering investments, but we also have to consider the cash flow realities.

For our example of the grain drying system, we must look at how to pay the capital cost of $30,000 if the farmer decides it is an acceptable investment.

PARTIAL BUDGET

Estimated change in annual farm profits from the proposed change of _using a heated air drying system in harvest management to start harvesting earlier and have more control of events._

Disadvantages (Debits)	Advantages (Credits)

1. Added Annual Costs Expected
Total variable costs - 2786
Fixed costs (non cash)
  Interest , depreciation 5025
  Housing   100
Fixed costs (cash)
  Insurance   200
  Power   120
Total Fixed Costs 5445
Total added Costs 8231
	3. Added Annual Receipts Expected
	Estimated benefits - 11583

2. Reduced Annual Receipts Expected nil	**4. Reduced Annual Costs Expected** No custom drying - 613
Total Disadvantages A. 8231	Total Advantages B. 12196
Estimated Change in Annual Farm Profits (B minus A) 12196 - 8231 = 3965	

OTHER CONSIDERATIONS OF PROPOSED CHANGE

Extra Capital Needed 30000	Degree of risk
Extra labor to hire included	Time lag until income starts 1 year
Other Disadvantages of Proposed Change Increase fixed costs Needs more management skill to operate and supervise.	**Other Advantages of Proposed Change** Earlier harvest More control of harvest Equipment can be sold.

Assuming the farmer does not have $30,000 in cash to buy the system, what kind of a loan will be most useful? A 10-year loan would correspond to the useful life estimated for the system, but a lender might not like to lend for such a long time. Five year loans are much more common so we have assumed a loan of $30,000 at 12 per cent for five years. The following worksheet shows yearly cash flow from the proposed change.

The figures entered on the cash flow worksheet are taken from the partial budget, except that noncash costs of $100 for housing and the interest and depreciation of $5,025 have not been entered in the cash flow. Instead of interest and depre-

ciation charges, the actual loan payments for a loan of $30,000 at 12 per cent interest amortized over five years were entered under annual added costs.

The total cost of the disadvantages was subtracted from total value of the advantages to show a cash surplus of $768 annually for the first five years, followed by five years with an annual cash surplus of $9,090.

The figures show that a loan with annual payments of $8,322 is feasible, but with a projected cash surplus of only $768, a farmer may want to look at other alternatives.

YEARLY CASH FLOW FOR PROPOSED CHANGE

YEAR	1	2	3	4	5	6	7	8	9	10
DISADVANTAGES										
1. Added annual costs										
Variable	2786	2786	2786	2786	2786	2786	2786	2786	2786	2786
Fixed (cash)	320	320	320	320	320	320	320	320	320	320
Loan payments (at 12%, 5 yr)	8322	8322	8322	8322	8322					
2. Reduced receipts	∅									
TOTAL DISADVANTAGES	11428	11428	11428	11428	11428	3106	3106	3106	3106	3106
ADVANTAGES										
3. Added annual receipts	11583	11583	11583	11583	11583	11583	11583	11583	11583	11583
4. Reduced annual costs	613	613	613	613	613	613	613	613	613	613
TOTAL ADVANTAGES	12196	12196	12196	12196	12196	12196	12196	12196	12196	12196
CASH SURPLUS OR DEFICIT	768	768	768	768	768	9090	9090	9090	9090	9090

If an alternative system could provide nearly all the benefits of the system in our example but show a larger surplus, it could be a better investment. The best way to compare systems is to work out the advantages and disadvantages and place a value on them. Then use the partial budget and cash flow tools to compare them on the same basis.

What are the risks?

Will all the calculating and consideration of alternatives cut down on the risk and uncertainty of future events? The answer is not much, but decision making under uncertain conditions can be improved. Very few people can make the correct decision every time. Plans may be well thought out but the future is unknowable. Decisions must be made and the best that managers can do is improve their batting average by using consistent and methodical procedures such as the partial budget and cash flow analysis to analyze information.

Income Tax - If farmers making a capital investment, such as the grain drying system shown in the example, expect to have taxable income in the years of use, they should also include the appropriate tax calculations in the projections.

Those calculations might include the effect of investment tax credits and capital cost allowances on cash flows. Taxable incomes and marginal tax rates will probably also be changed by the investment.

Farmers with a high taxable income can make use of investment tax credits and capital cost allowance deductions to decrease their taxable income and income tax, both of which reduce cash outflows. This would make their cash inflow surplus larger and the investment more attractive because of lower after-tax cash outflows.

Farmers with a low taxable income who get less advantage from tax deductions will find the investment less attractive because of higher after-tax cash outflows than farmers with higher taxable income.

Time Value of Money - Cash outflows and inflows paid out or received over a period of several years can be compared effectively only by calculating present values. More complex calculations and financial tables or financial calculators are required for this method of analysis.

Farm managers seriously interested in a more complete analysis can request help with more complex calculations by phoning or writing the writer of the article.

Summary

What advantage will a farmer have from working out the above example? So far, we have looked at only one alternative but we have used a method that can be used on all the alternatives a farmer has time to explore.

The question of whether it will pay has been answered for our one grain drying system in the example. Yes, it will pay if future events happen as they were projected. Few farmers or financial professionals would expect the future to unfold as projected, but a projection is better than no plan at all. Planning cannot eliminate the unpredictability of the future. If our plans and projections help us to respond more quickly and to expect the unexpected they will be useful.

Another point for a farmer to consider is whether he/she can afford it. Those who can pay for the system up front with cash will not have to do many calculations unless something drastic happens. Farmers with smaller cash flows may consider both cash flows and risks and perhaps how a loan might be acquired.

The final decision as to the purchase is for the farmer to make. After examining other alternatives using the above method, a farmer will be able to make a more informed decision.

Interested readers are invited to write to us at the Farm Business Management Branch, Box 2000, Olds, Alberta, T0M 1P0, to express their ideas on improving our articles and publications. We are interested in knowing if readers want articles showing how to do calculations for financial planning. Readers can also request individual help from our staff in making financial calculations they are not able to do themselves. Contact us by phone or letter.

Appendix
Calculations

Estimating Fixed Cost

For the example on page 8 a fixed cost of $5,025 was shown as the amortized fixed cost. Common practice (traditional method) is to estimate depreciation and interest to determine an annual combined fixed cost. The method used here is a capital recovery method which is proving to be more realistic than the traditional method.

The capital recovery method is based on the amount of money required at the end of each year to pay interest on the unrecovered capital at a designated interest rate and recover the capital invested within the specified number of years. In other words, the investors expect a return from the investment as if they had loaned money to the investment. In our example farmers would expect the drying system to return all the capital ($30,000) within the 10 years of use and pay interest at a rate equal to what they would earn in the next best investment.

The calculations used to find the annual fixed costs are a little more complex and require the use of financial tables which are included on pages 12 to 15.

Calculating Annual Capital Recovery Charge

The formula is:

$$\frac{(\text{Original Investment}) - (\text{Present value of salvage value})}{(\text{PV of single sum for 10 years at 12\% interest})}$$

divided by present value factor of a series of payments.

Original investment = $30,000
Salvage value at end of 10 years = $5,000
Look up present value factor for **10** years at **12%** in Table 1 which shows the present value of $1 to be received in the future.

In the column for 12% and the row for 10 years is the PV factor = .3220.

Multiply salvage value times .3220 = 5,000 x .3220 = 1,610 which is the present value of the $5,000 expected in 10 years.

Look up present value factor in Table 2 for 10 years at 12%. In the column for 12% and the row for 10 years is the PV factor = 5.650

Enter the numbers in the formula and perform calculations:

$30,000 - $1,610 = $28,390

$28,390 ÷ 5.650 = $5,025 (rounded from 5024.78)

So the annual charge for depreciation and interest using the capital recovery method = **$5,025**

DETAILED PARTIAL BUDGET WORKSHEET

Disadvantages: Quadrant #1 - Added Annual Costs Expected

VARIABLE COSTS   Your Farm

1. Fuel Costs

   __.3__ litres/bu x __17500__ bu x $ __.23__ litre   1208

2. Tractor Fuel

   .17500 bu / 200 bu/hr = __88__ hours x $2.50 hour   220

3. Lubrication 10% of fuel costs   143

4. Electric Power Costs $.0020 per bushel   35

5. Repairs 30000 x 1%   300

6. Labor 88 hours at $10 per hour (cash)   880

Total Variable Costs   2786
Variable Cost per Bushel
$2786 ÷ 17500 = 15.92 per bu

FIXED COSTS

Annualization of capital investment assuming equal annual fixed costs at opportunity cost rate.

Formula:
(Original Investment - Present Value of Salvage) divided by cumulative present value factor for use of machine for __10__ years at __12__ %.

$30,000 - $1,610 = $28,390

$28,390 ÷ 5.650 = 5025
                                           Amortized annual costs $ 5025

Insurance   200

Housing (estimated – not cash)   100

Increased in fixed monthly power bill   120

TOTAL FIXED COSTS   5445

Total added annual costs expected   8231

DETAILED PARTIAL BUDGET WORKSHEET

Disadvantages: Quadrant #2 - Reduced Annual Receipts Expected

Total Reduced Annual Receipts Expected ___*None*___

DETAILED PARTIAL BUDGET WORKSHEET
ESTIMATED ADDED RETURNS

Advantages: Quadrant #3 - Added Annual Receipts Expected

Your Farm

1. Grade Loss Avoided ($\frac{1}{2}$ of total harvest 1 grade better)
   __500__ acres x __35__ bu/ac x $ __.20__ bu differential   = __3500__

2. "Tough" Discount Avoided
   __250__ acres x __35__ bu/ac x $ __.20__ bu   = __1750__

3. Bushel Weight Saved
   __2__ lb/bu ÷ __60__ lb/bu x __500__ ac (continued)
   x __35__ bu/ac x $ __4.00__ /bu   = __2333__

4. Reduced Mechanical Losses
   __1__ bu/ac x __500__ ac = __500__ bu x $ __4.00__ bu   = __2000__

5. Reduced Natural Losses
   __$\frac{1}{2}$__ bu/ac x __1000__ ac x $ __4.00__ bu   = __2000__

6. In-Field Overdrying Avoided   _____

7. Improved Germination (seed or malt barley grade)   _____

8. Easier Marketing   _____

9. In Bin Spoilage Losses Reduced or Eliminated   _____

10. Non-Completion Losses Avoided   _____

11. More Time For Fall Work   _____

12. Custom Drying   _____

TOTAL ADDED ANNUAL RECEIPTS EXPECTED   __11 583__

DETAILED PARTIAL BUDGET WORKSHEET

Advantages: Quadrant #4 - Reduced Annual Costs Expected	Your Farm
1. Labor	
2. Reduced Swathing Costs	
3. Reduced Combining Costs	
4. Less Equipment Investment	
5. Save Custom Drying Costs	$613
6. Other	
Total Reduced Annual Costs Expected	$613

Table 1
SINGLE PAYMENT

PRESENT VALUE FACTORS

This table is used to determine the present value of a single payment received 'n' years from the present, or it may be used in reverse to find the future value of a given sum of money.

Years	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	.9901	.9804	.9709	.9615	.9524	.9434	.9346	.9259	.9174	.9091
2	.9803	.9612	.9426	.9246	.9070	.8900	.8734	.8573	.8417	.8264
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830
5	.9515	.9057	.8626	.8219	.7835	.7473	.7130	.6806	.6499	.6209
6	9420	.8880	.8375	.7903	.7462	.7050	.6663	.6302	.5963	.5645
7	.9327	.8706	.8131	.7599	.7107	.6651	.6227	.5835	.5470	.5132
8	.9235	.8535	.7894	.7307	.6768	.6274	.5820	.5403	.5019	.4665
9	.9143	.8368	.7664	.7026	.6446	.5919	.5439	.5002	.4604	.4241
10	.9053	.8203	.7441	.6756	.6139	.5584	.5083	.4632	.4224	.3855
11	.8963	.8043	.7224	.6496	.5847	.5268	.4751	.4289	.3875	.3505
12	.8874	.7885	.7014	.6246	.5568	.4970	.4440	.3971	.3555	.3186
13	.8787	.7730	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897
14	.8700	.7579	.6611	.5775	.5051	.4423	.3878	.3405	.2992	.2633
15	.8613	.7430	.6419	.5553	.4810	.4173	.3624	.3152	.2745	.2394
16	.8528	.7284	.6232	.5339	.4581	.3936	.3387	.2919	.2519	.2176
17	.8444	.7142	.6050	.5134	.4363	.3714	.3166	.2703	.2311	.1978
18	.8360	.7002	.5874	.4936	.4155	.3503	.2959	.2502	.2120	.1799
19	.8277	.6864	.5703	.4746	.3957	.3305	.2765	.2317	.1945	.1635
20	.8195	.6730	.5537	.4564	.3769	.3118	.2584	.2145	.1784	.1486
21	.8114	.6598	.5375	.4388	.3589	.2942	.2415	.1987	.1637	.1351
22	.8034	.6468	.5219	.4220	.3418	.2775	.2257	.1839	.1502	.1228
23	.7954	.6342	.5067	.4057	.3256	.2618	.2109	.1703	.1378	.1117
24	.7876	.6217	.4919	.3901	.3101	.2470	.1971	.1577	.1264	.1015
25	.7798	.6095	.4776	.3751	.2953	.2330	.1842	.1460	.1160	.0923
26	.7720	.5976	.4637	.3607	.2812	.2198	.1722	.1352	.1064	.0839
27	.7644	.5859	.4502	.3468	.2678	.2074	.1609	.1252	.0976	.0763
28	.7568	.5744	.4371	.3335	.2551	.1956	.1504	.1159	.0895	.0693
29	.7493	.5631	.4243	.3207	.2429	.1846	.1406	.1073	.0822	.0630
30	.7419	.5521	.4120	.3083	.2314	.1741	.1314	.0994	.0754	.0573
31	.7346	.5412	.4000	.2965	.2204	.1643	.1228	.0920	.0691	.0521
32	.7273	.5306	.3883	.2851	.2099	.1550	.1147	.0852	.0634	.0474
33	.7201	.5202	.3770	.2741	.1999	.1462	.1072	.0789	.0582	.0431
34	.7130	.5100	.3660	.2636	.1904	.1379	.1002	.0730	.0534	.0391
35	.7059	.5000	.3554	.2534	.1813	.1301	.0937	.0676	.0490	.0356
36	.6989	.4902	.3450	.2437	.1727	.1227	.0875	.0626	.0449	.0323
37	.6920	.4806	.3350	.2343	.1644	.1158	.0818	.0580	.0412	.0294
38	.6852	.4712	.3252	.2253	.1566	.1092	.0765	.0537	.0378	.0267
39	.6784	.4619	.3158	.2166	.1491	.1031	.0715	.0497	.0347	.0243
40	.6717	.4529	.3066	.2083	.1420	.0972	.0668	.0460	.0318	.0221

Table 1
SINGLE PAYMENT

PRESENT VALUE FACTORS (continued)

This table is used to determine the present value of a single payment received 'n' years from the present, or it may be used in reverse to find the future value of a given sum of money.

Years	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	.9009	.8929	.8850	.8772	.8696	.8621	.8547	.8475	.8403	.8333
2	.8116	.7972	.7831	.7695	.7561	.7432	.7305	.7182	.7062	.6944
3	.7312	.7118	.6931	.6750	.6575	.6407	.6244	.6086	.5934	.5787
4	.6587	.6355	.6133	.5921	.5718	.5523	.5337	.5158	.4987	.4823
5	.5935	.5674	.5428	.5194	.4972	.4761	.4561	.4371	.4190	.4019
6	.5346	.5066	.4803	.4556	.4323	.4104	.3898	.3704	.3521	.3349
7	.4817	.4523	.4251	.3996	.3759	.3538	.3332	.3139	.2959	.2791
8	.4339	.4039	.3762	.3506	.3269	.3050	.2848	.2660	.2487	.2326
9	.3909	.3606	.3329	.3075	.2843	.2630	.2434	.2255	.2090	.1938
10	.3522	.3220	.2946	.2697	.2472	.2267	.2808	.1911	.1756	.1615
11	.3173	.2875	.2607	.2366	.2149	.1954	.1778	.1619	.1476	.1346
12	.2858	.2567	.2307	.2076	.1869	.1685	.1520	.1372	.1240	.1122
13	.2575	.2292	.2042	.1821	.1625	.1452	.1299	.1163	.1042	.0935
14	.2320	.2046	.1807	.1597	.1413	.1252	.1110	.0985	.0876	.0779
15	.2090	.1827	.1599	.1401	.1229	.1079	.1949	.0835	.0736	.0649
16	.1883	.1631	.1415	.1229	.1069	.0930	.0818	.0708	.0618	.0541
17	.1696	.1456	.1252	.1078	.0929	.0802	.0693	.0600	.0520	.0451
18	.1528	.1300	.1108	.0946	.0808	.0691	.0592	.0508	.0437	.0376
19	.1377	.1161	.0981	.0829	.0703	.0596	.0506	.0431	.0367	.0313
20	.1240	.1037	.0868	.0728	.0611	.0514	.0433	.0365	.0303	.0261
21	.1117	.0926	.0768	.0638	.0531	.0443	.0370	.0309	.0259	.0217
22	.1007	.0826	.0680	.0560	.0462	.0382	.0316	.0262	.0218	.0181
23	.0907	.0738	.0601	.0491	.0402	.0329	.0270	.0222	.0183	.0151
24	.0817	.0659	.0532	.0431	.0349	.0284	.0231	.0188	.0154	.0126
25	.0736	.0588	.0471	.0378	.0304	.0245	.0197	.0160	.0129	.0105
26	.0663	.0525	.0417	.0331	.0264	.0211	.0169	.0135	.0109	.0087
27	.0597	.0469	.0369	.0291	.0230	.0182	.0144	.0115	.0091	.0073
28	.0538	.0419	.0326	.0255	.0200	.0157	.0123	.0097	.0077	.0061
29	.0485	.0374	.0289	.0224	.0174	.0135	.0105	.0082	.0064	.0051
30	.0437	.0334	.0256	.0196	.0151	.0116	.0090	.0070	.0054	.0042
31	.0394	.0298	.0226	.0172	.0131	.0100	.0077	.0059	.0046	.0035
32	.0355	.0266	.0200	.0151	.0114	.0087	.0066	.0050	.0038	.0029
33	.0319	.0238	.0177	.0132	.0099	.0075	.0056	.0042	.0032	.0024
34	.0288	.0212	.0157	.0116	.0086	.0064	.0048	.0036	.0027	.0020
35	.0259	.0189	.0139	.0102	.0075	.0055	.0041	.0030	.0023	.0017
36	.0234	.0169	.0123	.0089	.0065	.0048	.0035	.0026	.0019	.0014
37	.0210	.0151	.0109	.0078	.0057	.0041	.0030	.0022	.0016	.0012
38	.0190	.0135	.0096	.0069	.0049	.0036	.0026	.0019	.0013	.0010
39	.0171	.0120	.0085	.0060	.0043	.0031	.0022	.0016	.0011	.0008
40	.0154	.0107	.0075	.0053	.0037	.0026	.0019	.0013	.0010	.0007

Table 2

CUMULATIVE PRESENT VALUE FACTORS

This table is used to determine the present value of a series of 'n' payments.

Years	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
0 - 1	.990	.980	.971	.962	.952	.943	.935	.926	.917	.909
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791
6	5.795	5.601	5.417	5.242	5.076	4.971	4.767	4.623	4.486	4.355
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145
11	10.378	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763	9.122	8.544	8.022
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201
19	17.226	15.678	14.324	13.134	12.085	11.158	10.336	9.604	8.950	8.365
20	18.046	16.351	14.877	13.590	12.462	11.470	10.594	9.818	9.129	8.514
21	18.857	17.011	15.415	14.029	12.821	11.764	10.836	10.017	9.292	8.649
22	19.660	17.658	14.937	14.451	13.163	12.042	11.061	10.201	9.442	8.772
23	20.456	18.292	16.444	14.857	13.489	12.303	11.272	10.371	9.580	8.883
24	21.243	18.914	16.936	15.247	13.799	12.550	11.469	10.529	9.707	8.985
25	22.023	19.523	17.413	15.622	14.094	12.783	11.654	10.675	9.823	9.077
26	22.795	20.121	17.877	15.983	14.375	13.003	11.826	10.810	9.929	9.161
27	23.560	20.707	18.327	16.330	14.643	13.211	11.987	10.935	10.207	9.237
28	24.316	21.281	18.764	16.663	14.898	13.406	12.137	11.051	10.116	9.307
29	25.066	21.844	19.188	16.984	15.141	13.591	12.278	11.158	10.198	9.370
30	25.808	22.396	19.600	17.292	15.372	13.765	12.409	11.258	10.274	9.427
31	26.542	22.938	20.000	17.588	15.593	13.929	12.532	11.350	10.343	9.479
32	27.720	23.468	20.389	17.874	15.803	14.084	12.647	11.435	10.406	9.526
33	27.990	23.989	20.766	18.148	16.003	14.230	12.754	11.514	10.464	9.569
34	28.703	24.499	21.132	18.411	16.193	14.368	12.854	11.587	10.518	9.609
35	29.409	24.999	21.487	18.665	16.374	14.498	12.948	11.655	10.567	9.644
36	30.108	25.489	21.832	18.908	16.547	14.621	13.035	11.717	10.612	9.677
37	30.780	25.969	22.167	19.143	16.711	14.737	13.117	11.775	10.653	9.706
38	31.485	26.441	22.492	19.368	16.868	14.846	13.193	11.829	10.691	9.733
39	32.163	26.903	22.808	19.584	17.017	14.949	13.265	11.879	10.726	9.757
40	32.835	27.355	23.115	19.793	17.159	15.046	13.332	11.925	10.757	9.779

Table 2 [1]

CUMULATIVE PRESENT VALUE FACTORS (continued)

This table is used to determine the present value of a series of 'n' payments.

Years	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
0 - 1	.901	.893	.885	.877	.870	.862	.855	.848	.840	.833
2	1.712	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.546	1.528
3	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.102	3.307	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.489
5	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	4.230	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.405
8	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	6.206	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327
12	6.492	6.194	5.918	5.660	5.420	5.197	4.988	4.793	4.610	4.439
13	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	6.982	6.628	6.303	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	7.191	6.811	6.463	6.142	5.847	5.576	5.324	5.092	4.876	4.676
16	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730
17	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	7.702	7.250	6.840	6.468	6.128	5.818	5.534	5.273	5.033	4.812
19	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.844
20	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870
21	8.075	7.562	7.102	6.687	6.312	5.973	5.665	5.384	5.127	4.892
22	8.176	7.645	7.170	6.743	6.358	6.011	5.696	5.410	5.149	4.910
23	8.266	7.718	7.230	6.792	6.399	6.044	5.723	5.432	5.167	4.925
24	8.348	7.784	7.283	7.835	6.434	6.073	5.746	5.451	5.182	4.937
25	8.422	7.843	7.330	6.873	6.464	6.097	5.766	5.467	5.195	4.948
26	8.488	7.896	7.372	6.906	6.490	6.118	5.783	5.480	5.206	4.956
27	8.548	7.942	7.409	6.935	6.513	6.136	5.797	5.492	5.215	4.964
28	8.601	7.984	7.441	6.961	6.533	6.152	5.810	5.502	5.223	4.970
29	8.650	8.022	7.470	6.983	6.551	6.166	5.820	5.510	5.229	4.975
30	8.694	8.055	7.496	7.003	6.566	6.177	5.829	5.517	5.235	4.979
31	8.733	8.085	7.518	7.020	6.579	6.187	5.837	5.523	5.239	4.983
32	8.768	8.112	7.538	7.035	6.590	6.196	5.844	5.528	5.243	4.986
33	8.800	8.135	7.556	7.048	6.600	6.203	5.849	5.532	5.246	4.988
34	8.829	8.157	7.572	7.060	6.609	6.210	5.854	5.535	5.249	4.990
35	8.855	8.176	7.586	7.070	6.616	6.215	5.858	5.538	5.251	4.992
36	8.878	8.192	7.598	7.079	6.623	6.220	5.862	5.541	5.253	4.993
37	8.900	8.208	7.609	7.087	6.629	6.224	5.864	5.543	5.255	4.994
38	8.918	8.221	7.619	7.094	6.634	6.228	5.867	5.545	5.256	4.995
39	8.936	8.233	7.627	7.100	6.638	6.231	5.869	5.547	5.257	4.996
40	8.951	8.244	7.635	7.105	6.642	6.234	5.871	5.548	5.258	4.997

DETAILED PARTIAL BUDGET WORKSHEET

Disadvantages: Quadrant #1 - Added Annual Costs Expected

VARIABLE COSTS   Your Farm

1. Fuel Costs
    _____ litres/bu x _____ bu x _____ litre   _____

2. Tractor Fuel

    ....bu   =   _____ hours x _____ hour   _____
    ....bu/hr

3. Lubrication   _____

4. Electric Power Costs   _____

5. Repairs   _____

6. Labor   _____

Total Variable Costs   _____
Variable Cost per Bushel
_____ ÷ _____ = _____ per bu

FIXED COSTS

Annualization of capital investment assuming equal annual fixed costs at opportunity cost rate.

Formula:
(Original Investment - Present Value of Salvage) divided by cumulative present value factor for use of
    machine for _____ years at _____ %.

_____ ÷ _____ = _____

_____ ÷ _____ = _____
                                   Amortized annual costs   _____

Insurance   _____

Housing   _____

Increased in fixed monthly power bill   _____

TOTAL FIXED COSTS   _____

Total added annual costs expected   _____

DETAILED PARTIAL BUDGET WORKSHEET

Disadvantages: Quadrant #2 - Reduced Annual Receipts Expected

Total Reduced Annual Receipts Expected   _____

DETAILED PARTIAL BUDGET WORKSHEET
ESTIMATED ADDED RETURNS

Advantages: Quadrant #3 - Added Annual Receipts Expected

Your Farm

1. Grade Loss Avoided ($\frac{1}{2}$ of total harvest 1 grade better)
    _____ acres x _____ bu/ac x _____ bu differential   = _____

2. "Tough" Discount Avoided
    _____ acres x _____ bu/ac x _____ bu   = _____

3. Bushel Weight Saved
    _____ lb/bu ÷ _____ lb/bu x _____ ac (continued)
    x _____ bu/ac x _____ /bu   = _____

4. Reduced Mechanical Losses
    _____ bu/ac x _____ ac = _____ bu x _____ bu   = _____

5. Reduced Natural Losses
    _____ bu/ac x _____ ac x _____ bu   = _____

6. In-Field Overdrying Avoided   _____

7. Improved Germination (seed or malt barley grade)   _____

8. Easier Marketing   _____

9. In Bin Spoilage Losses Reduced or Eliminated   _____

10. Non-Completion Losses Avoided   _____

11. More Time For Fall Work   _____

12. Custom Drying   _____

TOTAL ADDED ANNUAL RECEIPTS EXPECTED   _____

DETAILED PARTIAL BUDGET WORKSHEET

Advantages: Quadrant #4 - Reduced Annual Costs Expected	Your Farm
1. Labor	_____
2. Reduced Swathing Costs	_____
3. Reduced Combining Costs	_____
4. Less Equipment Investment	_____
5. Save Custom Drying Costs	_____
6. Other	_____
Total Reduced Annual Costs Expected	_____

PARTIAL BUDGET

Estimated change in annual farm profits from the proposed change of _____ ____

_____

_____

_____

Disadvantages (Debits)	Advantages (Credits)
1. Added Annual Costs Expected	3. Added Annual Receipts Expected
2. Reduced Annual Receipts Expected	4. Reduced Annual Costs Expected
Total Disadvantages A.	Total Advantages B.
Estimated Change in Annual Farm Profits (B minus A)	

OTHER CONSIDERATIONS OF PROPOSED CHANGE

Extra Capital Needed _____	Degree of risk _____
Extra labor to hire _____	Time lag until income starts _____
Other Disadvantages of Proposed Change	Other Advantages of Proposed Change
_____	_____
_____	_____
_____	_____

PARTIAL BUDGET

Estimated change in annual farm profits from the proposed change of _____

Disadvantages (Debits)	Advantages (Credits)
1. Added Annual Costs Expected	3. Added Annual Receipts Expected
2. Reduced Annual Receipts Expected	4. Reduced Annual Costs Expected
Total Disadvantages A.	Total Advantages B.

Estimated Change in Annual Farm Profits (B minus A)

OTHER CONSIDERATIONS OF PROPOSED CHANGE

Extra Capital Needed	Degree of risk
Extra labor to hire	Timing until income starts
Other Disadvantages of Proposed Change	Other Advantages of Proposed Change

YEARLY CASH FLOW FOR PROPOSED CHANGE

YEAR											

DISADVANTAGES
 	
1. Added annual costs
        Variable
        Fixed (cash)
        Loan payments
 	
2. Reduced receipts											

TOTAL DISADVANTAGES											
ADVANTAGES 3. Added annual receipts 4. Reduced annual costs											
TOTAL ADVANTAGES											
CASH SURPLUS OR DEFICIT											